

**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
(Chapter II of the Patent Cooperation Treaty)  
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>040936PC</b>	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. <b>PCT/AU2004/001080</b>	International filing date (day/month/year) <b>12 August 2004</b>	Priority date (day/month/year) <b>15 August 2003</b>	
International Patent Classification (IPC) or national classification and IPC <b>Int. Cl.<sup>7</sup> C25B 1/04, C01B 3/02, 3/10</b>			
Applicant <b>PROTEGY LIMITED et al</b>			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <b>5</b> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p style="margin-left: 20px;">a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <b>3</b> sheets, as follows:</p> <div style="margin-left: 40px;"> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> </div> <p style="margin-left: 20px;">b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> <p>4. This report contains indications relating to the following items:</p> <div style="margin-left: 20px;"> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p> </div>			
Date of submission of the demand <b>8 March 2005</b>		Date of completion of the report <b>1 December 2005</b>	
Name and mailing address of the IPEA/AU <b>AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929</b>		Authorized Officer  <b>DAVID K. BELL</b> Telephone No. (02) 6283 2309	

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2004/001080

**Box No. I Basis of the report**

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages **1 to 10 and 12 to 16** as originally filed/furnished

pages\* **11** received by this Authority on **8 March 2005** with the letter of 8 March 2005

pages\* received by this Authority on with the letter of

☒ the claims:

pages as originally filed/furnished

pages\* as amended (together with any statement) under Article 19

pages\* **17 and 18** received by this Authority on **15 November 2005** with the letter of 15 November 2005

pages\* received by this Authority on with the letter of

☒ the drawings:

pages **1 and 2** as originally filed/furnished

pages\* received by this Authority on with the letter of

pages\* received by this Authority on with the letter of

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

\* If item 4 applies, some or all of those sheets may be marked "superseded."

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
**PCT/AU2004/001080**

## Box No. VI Certain documents cited

### 1. Certain published documents (Rule 70.10)

Application No. <u>Patent No.</u>	Publication date <u>(day/month/year)</u>	Filing date <u>(day/month/year)</u>	Priority date ( valid claim) <u>(day/month/year)</u>
JP 2004210597	29 July 2004	Unavailable	6 January 2003

### 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure

Date of non-written disclosure  
(day/month/year)

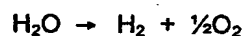
Date of written disclosure  
referring to non-written disclosure  
(day/month/year)

## Supplemental Box

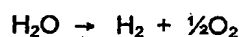
In case the space in any of the preceding boxes is not sufficient.

Continuation of: V

In addition, Claim 1 is merely a reiteration of the laws of thermodynamics and kinetics. Irrespective of how the water is finally dissociated the following is an expression of how the reaction proceeds with an increase in temperature. It clearly shows that an increase in temperature will increase the number of dissociated H<sub>2</sub>O molecules at or near the reactive or catalytic surface. In particular the reaction:



has an enthalpy of + 285.83 KJ/mol. Hence it is endothermic. Consequently the reaction follows the well known law of endothermic reactions, that is: "increased temperature favours the products". This is outlined in D13. The additional "restriction" introduced by way of Article 34 amendments, that "energy is added by the addition of steam instead of the energy provided as an applied electrical current" is merely substituting one form of energy for another and as a consequence the aforementioned and well known laws of thermodynamics still apply and there is no change in the scope of the claims. In the simplest terms the amount of energy required to convert:



remains constant irrespective of the pathway. Documents D5, D13 and D15 explicitly recognise this fundamental law of thermodynamics. The other documents take advantage of and implicitly recognise this law.

It is well understood that the reaction rate increases with an increase in temperature, again as outlined in D13. Documents D1 to D4 and D6 to D12 clearly disclose the application of these principles in the electrolysis of water, by elevating the temperature (in most cases to well above the boiling point of water) of the reactants during electrolysis. Consequently it is considered that claim 1 does not contain an element of novelty, nor does it involve an inventive step. It should also be noted that by definition a catalyst cannot change the equilibrium of the reaction. A catalyst simply increases the rate at which the reaction proceeds. Simply using steam to heat water irrespective of the catalyst (or reactive surface) used, or the final reaction temperature obtained is unlikely to produce a significant increase in the quantities of hydrogen fuel produced.

Document D14 by the applicant introduces the concept of combining two half cell reactions, with the idea of increasing hydrogen production. The teachings from this document may be combined with any of documents D1- D13 and D15 to produce a method of producing H<sub>2</sub> of the sort disclosed by D14 with an "increased number of dissociated H<sub>2</sub>O molecules" near the reactive surface. Consequently claims 2 to 11 do not involve an inventive step.

The invention as defined in the present claims is therefore not Novel and does not have an Inventive Step when compared to the disclosures of the cited documents D1 to D15. The invention is industrially applicable.

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/AU2004/001080**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	YES
	Claims 1 to 11	NO
Inventive step (IS)	Claims	YES
	Claims 1 to 11	NO
Industrial applicability (IA)	Claims 1 to 11	YES
	Claims	NO

## 2. Citations and explanations (Rule 70.7)

- D1 = WO 2000/017418 A1 (The Regents of the University of California), 30 March 2000
- D2 = GB 1490650 A (Blum P.), 2 November 1977
- D3 = GB 2010333 A (Kernforschungsanlage Julich GmbH), 27 June 1979
- D4 = WO 1994/012690 (Lasich J), 9 June 1994
- D5 = EP 1006078 A1 (Yosohiro S et al.), 7 June 2000
- D6 = DE 3101210 A1 (Dornier System GmbH.), 29 July 1982 & Derwent Abstract Accession No. 63841 E/31, Class E36, J03
- D7 = DT 2549471 A1 (Dornier System GmbH), 12 May 1977 & Derwent Abstract Accession No. 34643Y/20 Class E36, J03
- D8 = Derwent Abstract Accession No. 2000- 497491/44, Class E36, J03, PT 102238 A (Ramirez Garcia J.), 31 July 2000
- D9 = Derwent Abstract Accession No. 47774B/26, Class E36, J03, JP 54-061088 A (Hitachi Shipbld Eng KK), 17 May 1979
- D10 = ~~Derwent Abstract Accession No. 47775B/26, Class E36, J03, JP 54-061089 A (Hitachi Shipbld Eng KK), 17 May 1979~~
- D11 = Derwent Abstract Accession No. 33534 K/14, Class E36, J03, JP 58034183 A (Arakawa T), 28 February 1983
- D12 = Derwent Abstract Accession No. 94-084061/11, Class X25, CN 1072465 A (Zheng J), 26 May 1993
- D13 = "Physical Chemistry" 3<sup>rd</sup> Ed. P.W. Atkins, Oxford University Press, 1986. ISBN 0-19-855196-7.
- D14 = WO 2000/070699 (Protegy Limited), 23 November 2000
- D15 = "HYDROGEN PRODUCTION BY WATER SPLITTING USING MIXED CONDUCTING MEMBRANES" U. Balachandran, T. H. Lee, S. Wang, and S. E. Dorris February 2003, Manuscript to be submitted for publication in the Proceedings of the National Hydrogen Association's 14th Annual U.S. Hydrogen Meeting, Washington, DC, March 4-6, 2003.

The applicant's attention is directed to the document D5. This document clearly and unmistakeably discloses a process for generating hydrogen gas through direct thermal decomposition of water in which steam is used to heat water which is then passed under positive pressure and elevated temperature over a catalyst (zeolite) that separates hydrogen from the heated water. The invention defined in claims 1 to 11 is therefore not novel and does not have an inventive step when compared to the disclosure of D5.

Continued on supplemental sheet